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2 What is claimed is:

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- 4 1. In a system comprising a local processing device having a processor, a
5 memory for maintaining a local document, a transmission link to a remote
6 processing device, and a remote processing device having a processor and
7 storage within which a remote document is maintained, a method for
8 updating at least a portion of data elements of said remote document in
9 accordance with mutations made to a local document comprising the steps
10 of:
11
12 loading at least a portion of the structure of said remote document into a
13 local processing device as an XML document;
14
15 creating a logical document object model (DOM) having a plurality of nodes
16 arranged in a logical hierarchical structure such that each said node
17 corresponds to an XML tag and data element in said XML document;
18

1 mutating said XML document by adding, deleting, or modifying one or more
2 of said data elements;

3
4 updating said DOM to conform to said mutations to said XML document;

5
6 creating an entry in a first event table corresponding to each said mutation to
7 said XML document, each said entry comprising at least a path to a node in
8 said DOM affected by said mutation and an event type;

9
10 processing said first event table to create a second event table that will
11 contain the smallest number of mutation events necessary to update said
12 remote document such that, following the updating of said remote document,
13 mutated data elements in said modified XML document will have
14 corresponding data elements of the same value in said remote document;

15
16 transmitting said second event table and related data from said local device
17 to said remote device; and

1 mutating said remote document in accordance with events in said second
2 event table and related data such that said remote document will have
3 corresponding data elements of the same value as mutated data elements in
4 said modified XML document.

5
6 2. The method for updating a remote document as claimed in claim 1 in which
7 said step of processing said first event table to create a second event table
8 comprises the further steps of:

9
10 creating a sorted event table by alphabetically sorting events in said first
11 event table according to the XQL path of each said event, and secondarily
12 sorting identical XQL paths by date and time, such that paths to identical
13 nodes in the DOM will be listed with the first event in time being ahead of
14 events later in time, and nodes on the same branch of said DOM will be
15 grouped together such that shorter XQL paths will be listed ahead of longer
16 XQL paths on the same branch, and nodes on a common XQL branch will
17 be listed as a group;

1 processing events in said sorted event table in order by determining the type
2 of event as being a delete event, an add event, or a modify event;

3
4 and if said event is a delete event, saving said delete event and its XQL path
5 to said second event table as a delete event;

6
7 and, if said event is an add event, determining whether the node
8 corresponding to said add event was thereafter the subject of a delete event,
9 and if said node was thereafter the subject of a delete event, discarding said
10 add event and saving said delete event and its XQL path to said second event
11 table as a delete event, and if said node was not thereafter the subject of a
12 delete event, saving said add event and its XQL path to said second event
13 table as an add event;

14
15 and if said event is a modify event, determining whether the node
16 corresponding to said modify event was thereafter the subject of a delete
17 event, and if said node was thereafter the subject of a delete event,
18 discarding said modify event and saving said delete event and its XQL path
19 to said second event table as a delete event, and if said node was not

1 thereafter the subject of a delete event, determining whether said node was
2 the subject of an earlier add event or modify event, and if said node was the
3 subject of an earlier add event or modify event, discarding said modify
4 event, and if said node was not the subject of an earlier add event or modify
5 event, saving said modify event to said second event table as a modify event.
6

7 3. The method for updating a remote document as claimed in claim 2 in which
8 the step of transmitting said second event table and related data from said
9 local device to said remote device comprises the further steps of:

10
11 retrieving from said DOM a data value related to each add or modify event
12 in said second event table;

13
14 transmitting over said transmission link to said remote processing device the
15 XQL path for each event in said second event table, the type of event and,
16 for each said event that is an add or modify event, said data value related to
17 said add or modify event.
18

1 4. The method for updating a remote document as claimed in claim 3 wherein
2 said first processing device comprises a hand held device.
3

4 5. The method for updating a remote document as claimed in claim 3 wherein
5 said first processing device comprises a cellular telephone.
6

7 6. The method for updating a remote document as claimed in claim 3 wherein
8 said transmission link is a wireless communication link.
9

10 7. The method for updating a remote document as claimed in claim 3 wherein
11 said transmission link utilizes a medium having a maximum transmission
12 rate of approximately 56 kbps.
13

14 8. The method for updating a remote document as claimed in claim 3 wherein
15 said transmission link is conventional telephone lines.
16

17 9. The method for updating a remote document as claimed in claim 3 wherein
18 said transmission link is a computer network.
19

1 10. A method for updating a remote document on a remote processing device
2 from a local processing device comprising the steps of:
3
4 copying at least a relevant portion of said remote document onto said local
5 processing device;
6
7 formatting said relevant portion of said remote document on said local
8 device as an XML document;
9
10 creating a DOM corresponding to said XML document;
11
12 mutating to said XML document by adding, deleting, or modifying data
13 elements in said XML document;
14
15 recording the type of each said mutation to said XML document in a first list
16 together with information corresponding to the location in said DOM of said
17 mutation;
18

1 processing said first list to determine the smallest number of mutations
2 required to update said remote document such that, following said update,
3 there is a data element in said remote document corresponding to each data
4 element in said XML document;

5
6 creating a second list in which each entry corresponds to a mutation
7 determined to be one of said smallest number of mutations required to
8 update said remote document;

9
10 transmitting said second list and related data to said remote processing
11 device such that said remote document may be updated in accordance with
12 the entries in said second list.

13
14 11. The method for updating a remote document as claimed in claim 10 wherein
15 said relevant portion of said remote document comprises the structure of said
16 remote document.

1 12. The method for updating a remote document as claimed in claim 11 wherein
2 said relevant portion of said remote document further comprises data
3 elements.
4

5 13. The method for updating a remote document as claimed in claim 12 in which
6 said step of processing said first list includes the further steps of:
7

8 sorting said first list to cause the entries in said first list to be placed in
9 primary groups according to the location and path length of said data
10 elements in a branch of said DOM, and secondary groups within said
11 primary groups according to the date and time of each entry in said first list;
12

13 creating said second list by taking successive entries in said first list and
14 determining whether each said entry represents a delete event, an add event,
15 or a modify event;
16

17 and if said entry represents a delete event, saving said delete event and its
18 XQL path to said second list and ignoring all other events related to nodes in
19 the DOM located at or below the node related to said delete event;

1 and if said entry represents an add event occurring at a node that is not also
2 the subject of a delete event, saving said add event and its XQL path to said
3 second list and ignoring all other events related to nodes located at the same
4 XQL path;

5
6 and if said entry represents a first modify event occurring at a node that is
7 not also the subject of an add or delete event, saving said modify event and
8 its XQL path to said second list and ignoring all other events located at the
9 same XQL path;

10
11 and if said entry represents a modify event occurring at a node that has been
12 the subject of an earlier delete, add, or modify event, discarding said modify
13 event.

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16 14. Apparatus for updating a remote document comprising:

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18 a remote processing device comprising a remote machine readable storage
19 for storing a remote document;

1 a local processing device connected to said remote device by a transmission
2 link, said local device comprising a local machine readable storage having
3 stored thereon a local document, said local document comprising at least a
4 portion of said remote document;

5
6 said local machine readable storage maintaining said local document as an
7 XML document, said XML document having XML tags, each XML tag
8 corresponding to one of said data elements;

9
10 processor means for creating a DOM to be maintained in said local machine
11 readable storage, said DOM having an interface with said XML document
12 such that each said XML tag corresponds to a node in said DOM and each
13 said node has the same value as the data element corresponding to said XML
14 tag;

15
16 processor means for updating said DOM to correspond to mutations made to
17 said XML document such that additions, deletions or modifications to said
18 data elements in said XML document cause corresponding additions,
19 deletions or modifications to nodes of said DOM;

1
2 a keypad for entering mutations to said XML document;

3
4 storage means for recording said mutations as events in an event table, such
5 that each event in said event table comprises a path to the node of said DOM
6 corresponding to said event and an identifier of said event as an addition,
7 deletion, or modification;

8
9 processor means for parsing said event table to create a second event list
10 comprising the smallest number of events that will update said remote
11 database;

12
13 a transmission link to said remote device;

14
15 remote processor means for updating said remote database in accordance
16 with events contained in said second event list.

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18 15. The apparatus of claim 14 in which said transmission link comprises sending
19 and receiving antennae communicating through a wireless link.

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16. The apparatus of claim 14 in which said transmission link comprises a telephone line.

17. The apparatus of claim 14 in which said transmission link comprises a narrow band communications medium.

18. The apparatus of claim 14 in which said transmission link comprises a computer network.

19. The apparatus of claim 14 in which said local processing device comprises a hand held electronic device.

20. The apparatus of claim 14 in which said local processing device comprises a cellular telephone.

21. The apparatus of claim 14 in which said local processing device comprises a computer.